We claim:

1. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface.

2. The method of claim 1 wherein the act of converting comprises heating the layer.

3. The method of claim 1 wherein the act of converting comprises exposing the layer to a reducing ambient.

4. The method of claim 1 wherein the act of converting comprises exposing the layer to a reduced-pressure environment.

5. The method of claim 1 wherein the step of converting comprises converting at least a portion of the ruthenium oxide in the layer to ruthenium so as to produce a layer having a textured surface with a mean feature size of at least about 100 Angstroms.

6. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide to ruthenium by heating the layer in a reduced-pressure environment with a pressure of about 75 torr or less so as to produce a layer having a rough surface.

7. The method of claim 6 wherein the step of converting is performed in a reduced-pressure environment with a pressure of about 20 torr or less.

8. The method of claim 6 wherein the step of converting is performed in a reduced-pressure environment with a pressure of about 5 torr or less.

9. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting at least a portion of the ruthenium oxide to ruthenium by heating the layer to at least about 500°C in a reduced-pressure environment with a pressure of about 75 torr or less for a sufficient time so as to produce a layer having a rough surface.

10. The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 750°C.

11. The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 800°C.

12. The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 500°C for at least about 2 minutes.

13. The method of claim 9 wherein the act of converting is performed by heating the layer to at least about 500°C for a time in the range of about 2 to about 20 minutes.

14. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide; and

converting the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface.

15. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide;

converting some ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface; and

exposing the layer having a rough surface to a ambient suitable to decrease the tendency of the layer to react with surrounding material.

16. The method of claim 15 wherein the act of exposing comprises exposing the layer having a rough surface to an oxidizing ambient.

17. The method of claim 15 wherein the act of exposing comprises exposing the layer having a rough surface to nitrogen ambient.

18. The method of claim 15 wherein the act of exposing comprises exposing the layer having a rough surface to a nitrogen-supplying reducing ambient.

19. The method of claim 15 wherein the act of exposing comprises exposing the layer having a rough surface first to a nitrogen-supplying reducing ambient then to an oxidizing ambient.

20. A method of forming an enhanced-surface-area electrically conductive structure, the method comprising:

providing a layer containing ruthenium oxide; and

converting some ruthenium oxide in the layer to ruthenium by heating the layer in a reduced-pressure environment in a non-oxidizing ambient so as to produce a ruthenium-containing layer having a rough surface.

21. The method of claim 20 wherein the act of converting is performed in a nitrogen ambient.

22. The method of claim 20 wherein the act of converting is performed in a reducing ambient.

23. The method of claim 20 wherein the act of converting is performed in a nitrogen-supplying reducing ambient.

24. The method of claim 20 wherein the act of converting is performed in an ammonia-containing ambient.

25. The method of claim 20, wherein the act of converting is performed in a hydrogen-containing ambient.

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26. The method of claim 20, wherein the art of converting is performed in a helium-containing ambient.

27. The method of claim 20, wherein the art of converting is performed in a neon-containing ambient.

28. The method of claim 20, wherein the art of converting is performed in an argon-containing ambient.

29. The method of claim 20 further comprising exposing the layer having a rough surface to an oxidizing ambient.

30. A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

providing a layer containing ruthenium oxide;

selecting anneal conditions adapted to convert at least a portion of the ruthenium oxide to ruthenium; and

annealing the layer under said conditions so as to produce a layer having a rough surface.

31. A method of forming a ruthenium-containing enhanced-surface-area electrically conductive layer, the method comprising:

depositing a layer consisting essentially of ruthenium oxide onto a supporting structure; and

annealing the layer in reduced pressure environment in a non-oxidizing ambient so as to substantially convert the ruthenium oxide to ruthenium, leaving a roughened layer consisting essentially of ruthenium on the supporting structure.

32. A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

forming a layer of conducting material;

forming a layer comprising ruthenium oxide on the layer of conducting material; and

annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a layer having a textured surface with a mean feature size of about 100 Angstroms or more.

33. A method of forming an enhanced-surface-area electrically conductive layer, the method comprising:

providing a layer comprising ruthenium oxide;

annealing the layer comprising ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a textured surface with a mean feature size of about 100 Angstroms or more; and

forming a layer of electrically conductive material conformally over the resulting layer such that the surface of the conductive material away from the resulting layer has a textured surface generally corresponding to that of the resulting layer.

34 A method of forming a capacitor, the method comprising:

providing a layer containing ruthenium oxide;

converting least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface;

forming a layer of dielectric material over the resulting layer; and

forming a layer of conductive material over the layer of dielectric material.

35. The method of claim 34 wherein the act of forming a layer of dielectric material comprises forming a layer of high-dielectric-constant dielectric material.

36. The method of claim 34, wherein at least some of the ruthenium oxide is converted to ruthenium by annealing the layer at a pressure of 75 torr or less.

37. The method of claim 34, further comprising processing the layer containing ruthenium oxide to define a first electrode.

38. The method of claim 37, wherein the first electrode is defined by an etching process.

39. The method of claim 37, wherein the first electrode is defined by a chemical-mechanical polishing process.

40. The method of claim 37, wherein the first electrode is defined prior to converting at least some of the ruthenium oxide to ruthenium.

41. A method of forming a capacitor, the method comprising:

providing a first layer of electrically conductive material;

forming a layer containing ruthenium oxide on the layer of electrically conductive material;

annealing the layer containing ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium and so as to produce a rough resulting surface with a mean grain size of at least about 100 Angstroms;

forming a layer of dielectric material over the layer having a rough surface; and

forming a second layer of conductive material over the layer of dielectric material.

42. The method of claim 41 wherein the act of forming a layer of dielectric material comprises forming a layer of high-dielectric-constant dielectric material.

43. A method of forming a capacitor, the method comprising:

forming a first conductive layer containing tungsten nitride;

forming a layer of dielectric material over the first conductive layer; and

forming a second conductive layer over the layer of dielectric material.

44. The method of claim 43, further comprising annealing at least the first conductive layer at an anneal temperature sufficient to convert a tungsten nitride compound WN into a tungsten nitride compound W_2N.

45. The method of claim 44, wherein the anneal temperature is at least 500 C and the first conductive layer is maintained at the anneal temperature for at least 30 seconds.

46. The method of claim 44, wherein the first conductive layer is formed conformally on a post.

58. The integrated circuit of claim 56, further comprising a dielectric layer of tantalum pentoxide that covers the annealed tungsten nitride layer.

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59. A method of forming a passivated layer of ruthenium or ruthenium oxide during fabrication of an electronic device, the method comprising:

providing a layer of ruthenium or ruthenium oxide; and

annealing the layer in a nitrogen-supplying or nitrogen-supplying and reducing ambient so as to passivate the layer.

60. The method of claim 59 further comprising annealing the layer in an oxidizing ambient.

61. The method of claim 59 wherein the act of annealing comprises annealing in an ammonia ambient.

62. The method of claim 59 wherein the act of annealing comprises annealing in a mixture comprising hydrogen and nitrogen.

63. The method of claim ~~59~~ wherein the act of annealing comprises annealing in nitrogen.

64. A method of applying a conductive film, the method comprising:

applying a layer of tungsten nitride; and

annealing the tungsten nitride layer.

65. The method of claim 64, wherein the tungsten nitride layer includes a metastable tungsten nitride compound and the tungsten nitride layer is annealed at a temperature sufficient to convert at least some of the metastable compound to a stable compound.

43. ~~66.~~ A method of forming an array of capacitors, the method comprising:

providing a layer containing ruthenium oxide;

converting at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface;

forming a layer of dielectric material over the resulting layer;

forming a conductive layer on the layer of dielectric material; and

defining an array of electrodes by patterning at least one of the ruthenium oxide layer or the resulting layer.

44. ~~67.~~ The method of claim ~~66,~~ 43 wherein the array of electrodes is defined prior to forming the layer of dielectric material.

45. ~~68.~~ The method of claim ~~66~~ 43, wherein the array of electrodes is defined after forming the conductive layer on the dielectric layer.

C DV 46. ~~69.~~ The method of claim ~~65~~ ~~66~~ 43, wherein the array of electrodes is defined by etching.

C DV 47. ~~70.~~ The method of claim ~~65~~ ~~66~~ 43, wherein the array of electrodes is defined by chemical-mechanical polishing.

~~71. A DRAM, comprising an array of capacitors that includes electrodes defined in an enhanced-surface-area electrically conductive layer having a textured surface area with a mean surface area of about 100 Angstroms.~~

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47. The method of claim 44, wherein the first conductive layer is formed conformally in a recess in a substrate.

48. The method of claim 44, where the dielectric layer contains tantalum oxide.

49. A method of increasing a capacitance of a capacitor that includes a tungsten nitride electrode, the method comprising annealing the tungsten nitride layer at an anneal temperature sufficient to convert WN into W_2N.

50. The method of claim 49, wherein the anneal temperature is at least 500 C.

51. An integrated circuit comprising an enhanced-surface-area electrically conductive ruthenium-containing layer having a textured surface with a mean feature size of at least about 100 Angstroms.

52. An integrated circuit comprising an enhanced-surface-area electrically conductive nitrogen-passivated ruthenium-containing layer having a textured surface with a mean feature size of at least about 100 Angstroms.

53. An integrated circuit comprising an enhanced-surface-area electrically conductive nitrogen-passivated and oxygen-passivated ruthenium-containing layer having a textured surface with a mean feature size of at least about 100 Angstroms.

54. An integrated circuit comprising a nitrogen-passivated ruthenium-containing layer.

55. An integrated circuit comprising a nitrogen-passivated and oxygen-passivated ruthenium-containing layer.

56. An integrated circuit comprising an annealed tungsten nitride electrode layer.

57. The integrated circuit of claim 56, wherein the annealed tungsten nitride electrode layer consists essentially of W_2N.